CLAIMS

1. A method executable by a programmed processor for generating a binary Gray code, comprising:

providing an n-bit binary Gray code C^n;

using C^n, generating an n+2 bit binary Gray code C^{n+2} having 4M code words $c^n{}_0$ through $c^n{}_{N-1}$, where N is less than or equal to 2^n, by:

changing the leftmost bit between the code words $c^n{}_0$ and $c^n{}_1$;

finding the largest value M such that the rightmost bit changes between code words $c^n{}_{M-2}$ and $c^n{}_{M-1}$; and

forming $4M$ code words of C^{n+2} by extending the first M code words of C^n by a single bit at each end, with reversals in the order of the code words of C^n as required to yield an extended code X, wherein:

$$x_k^{n+2} = \begin{cases} [0, \quad c_k^n, \quad 0], & 0 < k \le M \\ [0, \quad c_{M-k+1}^n, \quad 1], & M < k \le 2M \\ [1, \quad c_k^n, \quad 1], & 2M < k \le 3M \\ [1, \quad c_{M-k+1}^n, \quad 0], & 3M < k \le 4M \end{cases}$$

2. The method of claim 1, wherein the n-bit binary code is a single bit binary code.

3. The method of claim 1, wherein the n-bit binary code is a two-bit binary code.

4. The method of claim 3, wherein the two bit binary code is given by a code table having four code words in the order {01}, {11}, {10},{00}.

5. The method of claim 1, wherein the n-bit binary code is a three-bit binary code.

6. The method of claim 5, wherein the three bit binary code is given by a code table having eight code words in the order {110}, {010}, {000},{001}, {011}, {111}, {101}, {100}.

7. A method executable by a programmed processor for generating a skew-tolerant Gray code having code words with co-ordinate positions, comprising:

receiving a number n representing the length of the code words;

if n is equal to or less than 3, selecting a predetermined code table containing 2, 4, or 8 code words, in which the predetermined tables having 4 or eight code words are characterized by at least two properties:

a first property that consecutive code words differ in only one co-ordinate position;

and a second property that, in each consecutive group of three consecutive code words, the first and third code words differ in only two adjacent coordinate positions;

otherwise, if n is even, selecting the predetermined code table containing 4 code words as a first code table, or if n is odd, selecting the predetermined code table with 8 code words as the first code table; and then performing the following recursion,

setting a parameter L to a value equal to the number of code words in the first code table;

forming a second code table from the first (3L/4+2) code words in the first code table;

forming a third code table by adding a zero at the beginning and end of each code word in the second code table;

forming a fourth code table by adding a one at the beginning and end of each code word in the second code table;

forming a fifth code table by reversing the order of code words in the second code table;

forming a sixth code table by adding a zero at the beginning and a one at the end of each code word in the fifth code table;

forming a seventh code table by adding a one at the beginning and a zero at the end of each code word in the fifth code table;

forming an eighth code table by concatenating corresponding code words of the third, fourth, sixth, and seventh code tables;

if the length of the code words in the eighth code table is less than n, continuing the recursion using the eighth code table as the first code table; otherwise, ending the recursion.

8. The method of claim 7, wherein the predetermined code table having four code words is given by the four code words in the order {01}, {11}, {10},{00}.

9. The method of claim 7, wherein the predetermined code table having eight code words is given by the eight code words in the order {110}, {010}, {000},{001}, {011}, {111}, {101}, {100}.

10. A program medium having computer-readable code means for performing a method to generate a binary Gray code, the method comprising:

providing an n-bit binary Gray code C^n;

using C^n, generating an n+2 bit binary Gray code C^{n+2} having 4M code words c^n_0 through c^n_{N-1}, where N is less than or equal to 2^n, by:

changing the leftmost bit between the code words c^n_0 and c^n_1;

finding the largest value M such that the rightmost bit changes between code words c^n_{M-2} and c^n_{M-1}; and

forming $4M$ code words of C^{n+2} by extending the first M code words of C^n by a single bit at each end, with reversals in the order of the code words of C^n as required to yield an extended code X, wherein:

$$x_k^{n+2} = \begin{cases} [0, \quad c_k^n, \quad 0], & 0 < k \le M \\ [0, \quad c_{M-k+1}^n, \quad 1], & M < k \le 2M \\ [1, \quad c_k^n, \quad 1], & 2M < k \le 3M \\ [1, \quad c_{M-k+1}^n, \quad 0], & 3M < k \le 4M \end{cases}$$

11. The program medium of claim 10, wherein the *n*-bit binary code is a single bit binary code.

12. The program medium of claim 10, wherein the *n*-bit binary code is a two-bit binary code.

13. The program medium of claim 12, wherein the two bit binary code is given by a code table having four code words in the order {01}, {11}, {10},{00}.

14. The program medium of claim 10, wherein the *n*-bit binary code is a three-bit binary code.

15. The program medium of claim 14, wherein the three bit binary code is given by a code table having eight code words in the order {110}, {010}, {000},{001}, {011}, {111}, {101}, {100}.

16. A program medium having computer-readable code means for performing a method to generate a skew-tolerant Gray code having code words with co-ordinate positions, comprising:

receiving a number n representing the length of the code words;

if n is equal to or less than 3, selecting a predetermined code table containing 2, 4, or 8 code words, in which the predetermined tables having 4 or eight code words are characterized by at least two properties:

a first property that consecutive code words differ in only one co-ordinate position;

and a second property that, in each consecutive group of three consecutive code words, the first and third code words differ in only two adjacent coordinate positions;

otherwise, if n is even, selecting the predetermined code table containing 4 code words as a first code table, or if n is odd, selecting the predetermined code table with 8 code words as the first code table; and then performing the following recursion,

setting a parameter L to a value equal to the number of code words in the first code table;

forming a second code table from the first (3L/4+2) code words in the first code table;

forming a third code table by adding a zero at the beginning and end of each code word in the second code table;

forming a fourth code table by adding a one at the beginning and end of each code word in the second code table;

forming a fifth code table by reversing the order of code words in the second code table;

forming a sixth code table by adding a zero at the beginning and a one at the end of each code word in the fifth code table;

forming a seventh code table by adding a one at the beginning and a zero at the end of each code word in the fifth code table;

forming an eighth code table by concatenating, in order, the rows of the third, sixth, fourth, and seventh code tables;

if the length of the code words in the eighth code table is less than n, continuing the recursion using the eighth code table as the first code table; otherwise,

ending the recursion.

17. The program medium of claim 16, wherein the predetermined code table having four code words is given by the four code words in the order {01}, {11}, {10},{00}.

18. The program medium of claim 16, wherein the predetermined code table having eight code words is given by the eight code words in the order {110}, {010}, {000},{001}, {011}, {111}, {101}, {100}.

19. An apparatus for decoding a code word of a skew-tolerant Gray code sequence, comprising:

a first selector responsive to a root code word in the code word for selecting an initial code sequence position p;

at least a second selector responsive to an extension of the root code word in the code word for selecting sign and offset values with which to adjust p;

at least one arithmetic unit for combining the sign value with p to produce a signed value of p;

at least one arithmetic unit for combining the signed value of p with the offset value to produce an interim value of p; and

at least one arithmetic unit for performing a modulo calculation of the interim value of p to produce an adjusted value of p.

20. The apparatus of claim 19, further including a lookup table associating root code words with respective values of p, wherein the first selector includes a multiplexer having a control input for receiving a root code word and a data input for receiving a value of p from the table which is associated with the root code word received by the control input.

21. The apparatus of claim 21, further including at least one lookup table associating extensions of the root code word with sign and offset values, wherein the at least a second selector includes a multiplexer having a control input for receiving an extension of the root code word and a data input for receiving sign and offset values from the at least one lookup table which are associated with the extension.